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Note on the Development of the Ghor by the canalisation of the River Jordan and River Yarmuk.

By Mr. G. F. Walpole, Director of Lands and Surveys to the Transjordan Government.

1. The total area of land in the Ghor which is capable of irrigation is approximately 375,000 dunums. Of this area 182,250 dunums is already being irrigated by the W. el Arab, Wadi Ziqlab, Wadi Yabis, Wadi Kufrinji, Wadi Zarqa, Wadi Shueib and Wadi Kufrein, on a two, three and four face basis as the following schedule shows:-

Area under cultivation by irrigation on	two faces	115,000
" " " " "	three faces	25,200
" " " " "	four faces	40,050

The object of cultivation on a basis of three and four faces is the desire of the cultivators to acquire and retain their ownership of these lands ignoring the fact that in doing so much water is being wasted by ~~seepage~~ losses in canals and by evaporation.

2. Both the River Jordan and the River Yarmuk can be diverted into canals and the water employed in irrigation the whole area of irrigable land on the east side of the River Jordan between the Yarmuk and the Dead Sea.

The best site, and as far as is known at present the only one, for the off take of a canal from the Jordan is from the reservoir of the Palestine Electric Corporation at Jisr el Majami.

3. As regards the R. Yarmuk, the off take of the canal can either be at the site of the summer dam built each year by the cultivators of Adasiya or further up stream at the point the Yarmuk enters the Ghor from the gorge.

Mr. Ionides prepared a tentative scheme for the canalisation of the R. Yarmuk capable of irrigating approximately 45,000 dunums by taking 2 M^3 per second from the River Yarmuk, but the mean of discharge of the River Yarmuk is 7.5.M3 per second during the summer months. It is therefore safe to assume that the mean summer discharge of the R. Yarmuk is capable of irrigating an area of 105,000 dunums as a scheme entirely separate from the R. Jordan, on the basis that 1 M^3 per second will irrigate 15,000 dunums of mixed crops.

The water duty per dunum assumed by Mr. Ionides for the scheme he outlined is 1,200 M^3 per dunum per year which is in my opinion a low figure for intensive cultivation. A better figure would be in the nature of 2100 M^3 per dunum per year, equivalent to 1 M^3 sec per 15,000 dunums. If arrangements could be made for storing surplus water of the Yarmuk during the winter season it might be possible to provide sufficient water for a much larger area.

4. As already stated the best site for the off take of a canal from the River Jordan is at the reservoir at Jisr el Majami.

If the two schemes, the Jordan and the Yarmuk, are combined then it will clearly be less expensive to collect the discharges of both streams into one

main canal rather than have a high level canal from the Yarmuk and a low level canal from the Jordan. The Yarmuk of course can be diverted into a canal at a higher level than the canal from the Jordan, but if both are combined into one canal at the lower level it is probable that any loss of command can be taken care of by the W. el Arab and the W. Ziqlab coming in from the high plateau.

According to figures supplied by the Palestine Electric Corporation covering the period 1934 to 1946, the mean annual discharge of the R. Jordan at the Dagania regulating sluices was 529,673,000 M^3 and the mean annual discharge of the R. Yarmuk for the same period was 472,182,000 M^3 giving the mean annual discharge of both rivers 1001,855,000 M^3. It is interesting to note that if the winter discharge of the Yarmuk could be stored for the summer months there would be sufficient water from this river alone to irrigate 2/3rd of the Ghor on the east side of the R. Jordan on the basis that 1 M^3 per second will irrigate 15,000 dunums.

According to Mr. Ionides to irrigate a gross area of 300,000 dunums, an annual supply of 507 million cubic metres is required. Of this amount 123 million cubic metres will be available from the streams flowing in from the plateau, leaving 384 million cubic metres to be found from the River Jordan and Yarmuk. In my opinion the figure of 507 million cubic metres suggested by Mr. Ionides is too low and it would be advisable to increase this amount by 25% making the total figure 634 million cubic metres to permit the intensive cultivation of at least 50% of the total area as, unless intensive cultivation is carried out over a considerable part of the area, any scheme involving a long and costly main canal with distributories could not be an economic proposition. 511 million cubic metres would therefore be required from the Jordan and Yarmuk, that is to say just over half the mean annual discharge of both rivers.

The figure of 375,000 dunums of irrigable land in the Jordan Valley is based on the survey carried out by this Department between 1928 and 1933. Experience has since shown that this figure is on the conservative side and it may be taken that under a proper system of canalization of all available water supplies the total area commanded will probably be 5 to 10% greater. There is all the more reason, therefore, to assume a generous value for the annual amount of water required for irrigation in the Jordan Valley in the preliminary investigations.

5. To summarise the above:-

Two separate irrigation schemes can be studied.

(a) A high level canal from the Yarmuk taking 7 M^3 per second to irrigate 105,000 dunums intensively. Such a canal could not be incorporated usefully in any future scheme taking water from the Jordan.

(b) A canal taking sufficient water from both the Yarmuk and the Jordan to irrigate all irrigable land in the Jordan Valley between

the Yarmuk and the Dead Sea. There would be a certain loss of command in the early stages of such a canal but it is very likely that the W. el Arab and W. Ziqlab could take care of the areas un-commanded in Ghor el Arbain, while Baqura and Adasiya could be irrigated from the subsidiary canal taking off from the Yarmuk in the gorge.

6. The Department of Lands & Surveys has neither the equipment nor the staff capable of carrying out the hydrological and ground surveys that would be required for the detailed design of works and the preparation of estimates of costs. Such surveys, if they are to have any value, must be carried out within a reasonable time and it is recommended that a firm of engineers should be asked to examine the whole question of the development of the Jordan Valley, carry out th surveys and prepare estimates for submission to the Government.

It is suggested that the Crown Agents for the Colonies be approached and asked to recommend a firm of engineers who are in a position to investigate the development of the R. Jordan and R. Yarmuk from the irrigation point of view.

(Sgd) G. F. Walpole
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